Appendix C. Boundary Condition Types

Specific application details for many of the boundary condition types are included in Chapter 3.

Boundary condition types (IBTYP)

Type	*Description*
-1	Inviscid adiabatic wall for orphan points only
1	Inviscid adiabatic wall (pressure extrapolation)
2	Inviscid adiabatic wall (normal momentum equation)
3	Inviscid constant temperature wall (pressure extrapolation) (Wall temperature specified by BCPAR1 – degrees Rankine)
4	Inviscid constant temperature wall (normal momentum eqn) (Wall temperature specified by BCPAR1 – degrees Rankine)
5	Viscous adiabatic wall (pressure extrapolation)
6	Viscous adiabatic wall (normal momentum equation)
7	Viscous constant temperature wall (pressure extrapolation) (Wall temperature specified by BCPAR1 – degrees Rankine)
8	Viscous constant temperature wall (normal momentum eqn) (Wall temperature specified by BCPAR1 – degrees Rankine)
9	Viscous adiabatic wall with rotation about the positive x, y, or z-axis (Rotation rate specified by BCPAR1, axis specified by BCPAR2=1,2,3 for x,y,z, resp.)
10	Periodic condition (apply to either 1 or last plane)
11	Symmetry in X (apply to 1 and/or last separately). Requires a reflection plane.
12	Symmetry in Y (apply to 1 and/or last separately). Requires a reflection plane.
13	Symmetry in Z (apply to 1 and/or last separately). Requires a reflection plane.
14	Axis (J around) (Order of extrapolation given by BCPAR1)
15	Axis (K around) (Order of extrapolation given by BCPAR1)
16	Axis (L around) (Order of extrapolation given by BCPAR1)
17	Symmetry with no reflection plane
18	Periodic flow/nonperiodic grid (apply to either 1 or last plane)
21	2D condition in Y (3 planes supplied, ±1 in Y) (apply to first or last plane)
22	Axisymmetric condition in Y, rotate about X (3 planes supplied, $\pm 1^{o}$ rotation) (apply to first or last plane)
30	Outflow (pure extrapolation)
31	Characteristic condition based on Riemann invariants
32	Supersonic/subsonic inflow/outflow
33	Specified pressure outflow (Outflow pressure given by BCPAR1 = p/p_∞)
34	Specified mass flow through FOMOCO component (constant pressure) (Target mass flow specified by BCPAR1 = $\rho/\rho_\infty * u/u_\infty * A/A_{ref}$) (Update rate and relaxation specified by BCPAR2 as update.relaxation) (Component name from FOMOCO input specified by BCFILE; A_{ref} will also be taken from this file)
35	Outflow (1st-order extrapolation of pressure, velocity, and stagnation enthalpy)
36	Specified mass flow through FOMOCO component (variable pressure) (Specification same as BC#34)
37	Rotor far-field source/sink condition. Requires CTP and ASPCTR from NAMELIST
40	Impose free stream
41	Nozzle inflow (p_0, T_0 constant, mass flow extrapolated) (BCPAR1 = $p_0/p_{0\infty}$, BCPAR2 = $T_0/T_{0\infty}$)

42 Prescribed Q (read from file)
(BCPAR1 = starting iteration)
(BCPAR2 >0 use slow start)
(BCFILE – Name of file to read for Q)
OPEN(10,FILE=BCFILE,STATUS='OLD',FORM='UNFORMATTED')
READ(10) J1,K1,L1
READ(10)
READ(10) Q(JS:JE,KS:KE,LS:LE,1:NQ)

44 Actuator disk (IDIR is flow direction)
(BCPAR1 = $\Delta p/p_\infty$)

45 Prescribed Q (read from file)/inflow-outflow condition
(BCPAR1 = starting iteration)
(BCPAR2 >0 use slow start)
(BCFILE – Name of file to read for Q)
OPEN(10,FILE=BCFILE,STATUS='OLD',FORM='UNFORMATTED')
READ(10) J1,K1,L1
READ(10)
READ(10) Q(JS:JE,KS:KE,LS:LE,1:NQ)

47 Characteristic outflow condition based on Riemann invariants with freestream imposed on incoming characteristics

48 Simple jet mass flow condition
(BCPAR1 = $(\rho V)_{jet}/(\rho V)_\infty$)

49 Default (no change)

51 C-grid flow-through (J is C-direction)(specify one side)

52 C-grid flow-through (K is C-direction)(specify one side)

53 C-grid flow-through (L is C-direction)(specify one side)

54 Fold-over cut flow-through (fold-over in J)

55 Fold-over cut flow-through (fold-over in K)

56 Fold-over cut flow-through (fold-over in L)

57 C-grid at a wall (apply wall first) (J is C-direction)

58 C-grid at a wall (apply wall first) (K is C-direction)

59 C-grid at a wall (apply wall first) (L is C-direction)

61 Blank out region (set IBLANK=0)

70 Copy to (must be immediately followed by a "copy from")

71 Copy from

82 Slotted wind tunnel wall (modify wall pressure)
(BCPAR1 = R)

86 Wind tunnel exit specified mass flow condition
(BCPAR1 = A_{exit}/A_{ref})

141 Plug nozzle inflow (p_0, T_0 constant; density, velocity, and pressure extrapolated and averaged across face)
(BCPAR1 = $p_0/p_{0\infty}$, BCPAR2 = $T_0/T_{0\infty}$)

142 Time-varying velocity perturbation condition
(BCPAR1 = step to begin transient)
(BCFILE = file name for transient)
READ(20,*) XMIN,XMAX,XFREQ,XPHASE
VSCALE = 0.5*(XMAX+XMIN)+0.5*(XMAX-XMIN)*COS(2.*PI*(XFREQ*TIME+XPHASE))

143 Plug nozzle inflow, constant across FOMOCO component (p_0, T_0 constant; density, velocity, and pressure extrapolated and averaged across face)
(BCPAR1 = $p_0/p_{0\infty}$, BCPAR2 = $T_0/T_{0\infty}$, BCFILE = Component name from FOMOCO input)

144 Prop/rotor model of Mark Chaffin (NASA Langley)
145 Prop/rotor source term model from Mark Chaffin (NASA Langley)

148 Time-varying simple jet mass flow condition
(BCPAR1 = $(\rho V)_{jet}/(\rho V)_{\infty}$)

201 Unsteady flow output option
(Output file name given by BCFILE; BCPAR1 = starting iteration, BCPAR2 = iteration increment)

601 Vortex generator vane source term model of Kenrick Waithe (NASA Langley)